CLAIMS

We claim:

1. A method of forming an FSG film, comprising the steps of:

providing a structure; and

forming an FSG film over the structure by an HDP-CVD process under the following conditions:

a) no Argon (Ar) - side sputter;

b) an SiF_4 flow: from about 53 to 63 sccm;

c) an N_2 flow: from about 25 to 35 sccm; and

d) an RF power to provide a uniform plasma density.

2. The method of claim 1, wherein the structure is comprised of silicon.

3. The method of claim 1, wherein the SiF_4 flow is about 58 sccm and the N_2 flow is about 30 sccm.

4. The method of claim 1, wherein the RF power to provide a uniform plasma density includes:

a) an RF top power of from about 1450 to 1550W;

b) an RF side power of from about 3300 to 3500W; and

c) a bias RF power of from about 2575 to 2625 W.

5. The method of claim 1, wherein the RF power to provide a uniform plasma density includes:

a) an RF top power of about 1500W;

b) an RF side power of about 3400W; and

c) a bias RF power of about 2600 W.

6. The method of claim 1, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of from about 4 to 6 sccm;

b) an SiH_4 flow - side of from about 50 to 56 sccm;

c) an SiH_4 flow - top of from about 2.8 to 3.2 sccm; and

d) O_2 flow of from about 133 to 143 sccm.

7. The method of claim 1, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of about 5 sccm;

b) an SiH_4 flow - side of about 53 sccm;

c) an SiH_4 flow - top of about 3.0 sccm; and

d) O_2 flow of about 138 sccm.

8. The method of claim 1, wherein the FSG film includes the following characteristics:

a) a dielectric constant (k) of from about 3.3 to 3.5;

b) a gap filling ability of from about 0.17 to 0.19μm;

c) a deposition rate of from about 4400 to 4800Å; and

d) a F% of from about 6.80 to 7.40%.

9. The method of claim 1, wherein the formed FSG film includes the following characteristics:

a) a dielectric constant (k) of about 3.4;

b) a gap filling ability of about 0.18μm;

c) a deposition rate of about 4600Å; and

d) a F% of about 7.10%.

10. The method of claim 1, wherein the formed FSG film has a gap filling ability of from about 0.19 to 0.21μm.

11. The method of claim 1, wherein the formed FSG film has a gap filling ability of from about 0.17 to 0.21μm.

12. The method of claim 1, wherein the formed FSG film includes the following characteristics:

a) THK U% of from about 1.75 to 1.81%;

b) WIW range of from about 250 to 350Å;

c) a D/E of from about 2.65 to 2.71; and

d) a %F%U of from about 2.3 to 2.7%.

13. The method of claim 1, wherein the formed FSG film 16 includes the following characteristics:

a) THK U% of from about 1.78%;

b) WIW range of from about 300Å;

c) a D/E of from about 2.68; and

d) a %F%U of from about 2.5%.

14. The method of claim 1, wherein the formed FSG film does not form appreciable Si-OH bonds within about a week of formation.

15. The method of claim 1, wherein the fluorine within the formed FSG film does not appreciably outgas from the formed FSG film.

16. The method of claim 1, including the step of forming at least two adjacent metal structure upon the structure before the formation of FSG film.

17. The method of claim 1, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film.

18. The method of claim 1, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film; the metal structure being comprised of copper, aluminum or gold.

19. The method of claim 1, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not

clipped by the deposition of the FSG film; the metal structure being comprised of copper or aluminum.

20. A method of forming an FSG film, comprising the steps of:

providing a structure; and

forming an FSG film over the structure by an HDP-CVD process under the following conditions:

a) no Argon (Ar) - side sputter;

b) an SiF_4 flow: from about 53 to 63 sccm;

c) an N_2 flow: from about 25 to 35 sccm; and

d) an RF power to provide a uniform plasma density; wherein the RF power to provide a uniform plasma density includes:

i) an RF top power of from about 1450 to 1550W;

ii) an RF side power of from about 3300 to 3500W; and

iii) a bias RF power of from about 2575 to 2625 W.

21. The method of claim 20, wherein the structure is comprised of silicon.

22. The method of claim 20, wherein the SiF_4 flow is about 58 sccm and the N_2 flow is about 30 sccm.

23. The method of claim 20, wherein the RF power to provide a uniform plasma density includes:

a) an RF top power of about 1500W;

b) an RF side power of about 3400W; and

c) a bias RF power of about 2600 W.

24. The method of claim 20, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of from about 4 to 6 sccm;

b) an SiH_4 flow - side of from about 50 to 56 sccm;

c) an SiH_4 flow - top of from about 2.8 to 3.2 sccm; and

d) O_2 flow of from about 133 to 143 sccm.

25. The method of claim 20, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of about 5 sccm;

b) an SiH_4 flow - side of about 53 sccm;

c) an SiH_4 flow - top of about 3.0 sccm; and

d) O_2 flow of about 138 sccm.

26. The method of claim 20, wherein the FSG film includes the following characteristics:

a) a dielectric constant (k) of from about 3.3 to 3.5;

b) a gap filling ability of from about 0.17 to 0.19μm;

c) a deposition rate of from about 4400 to 4800Å; and

d) a F% of from about 6.80 to 7.40%.

27. The method of claim 20, wherein the formed FSG film includes the following characteristics:

a) a dielectric constant (k) of about 3.4;

b) a gap filling ability of about 0.18μm;

c) a deposition rate of about 4600Å; and

d) a F% of about 7.10%.

28. The method of claim 20, wherein the formed FSG film has a gap filling ability of from about 0.19 to 0.21μm.

29. The method of claim 20, wherein the formed FSG film has a gap filling ability of from about 0.17 to 0.21μm.

30. The method of claim 20, wherein the formed FSG film includes the following characteristics:

a) THK U% of from about 1.75 to 1.81%;

b) WIW range of from about 250 to 350Å;

c) a D/E of from about 2.65 to 2.71; and

d) a %F%U of from about 2.3 to 2.7%.

31. The method of claim 20, wherein the formed FSG film 16 includes the following characteristics:

a) THK U% of from about 1.78%;

b) WIW range of from about 300Å;

c) a D/E of from about 2.68; and

d) a %F%U of from about 2.5%.

32. The method of claim 20, wherein the formed FSG film does not form appreciable Si-OH bonds within about a week of formation.

33. The method of claim 20, wherein the fluorine within the formed FSG film does not appreciably outgas from the formed FSG film.

34. The method of claim 20, including the step of forming at least two adjacent metal structure upon the structure before the formation of FSG film.

35. The method of claim 20, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film.

36. The method of claim 20, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film; the metal structure being comprised of copper, aluminum or gold.

37. The method of claim 20, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not

clipped by the deposition of the FSG film; the metal structure being comprised of copper or aluminum.

38. A method of forming an FSG film, comprising the steps of:

providing a structure; and

forming an FSG film over the structure by an HDP-CVD process under the following conditions:

a) no Argon (Ar) - side sputter;

b) an SiF_4 flow: about 58 sccm;

c) an N_2 flow: about 30 sccm; and

d) an RF power to provide a uniform plasma density; wherein the RF power to provide a uniform plasma density includes:

i) an RF top power of about 1500W;

ii) an RF side power of about 3400W; and

iii) a bias RF power of about 2600 W.

39. The method of claim 38, wherein the structure is comprised of silicon.

40. The method of claim 38, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of from about 4 to 6 sccm;

b) an SiH_4 flow - side of from about 50 to 56 sccm;

c) an SiH_4 flow - top of from about 2.8 to 3.2 sccm; and

d) O_2 flow of from about 133 to 143 sccm.

41. The method of claim 38, wherein the FSG film is formed over the structure under the following additional conditions:

a) an Ar top sputter of about 5 sccm;

b) an SiH_4 flow - side of about 53 sccm;

c) an SiH_4 flow - top of about 3.0 sccm; and

d) O_2 flow of about 138 sccm.

42. The method of claim 38, wherein the FSG film includes the following characteristics:

a) a dielectric constant (k) of from about 3.3 to 3.5;

b) a gap filling ability of from about 0.17 to 0.19μm;

c) a deposition rate of from about 4400 to 4800Å; and

d) a F% of from about 6.80 to 7.40%.

43. The method of claim 38, wherein the formed FSG film includes the following characteristics:

a) a dielectric constant (k) of about 3.4;

b) a gap filling ability of about 0.18μm;

c) a deposition rate of about 4600Å; and

d) a F% of about 7.10%.

44. The method of claim 38, wherein the formed FSG film has a gap filling ability of from about 0.19 to 0.21μm.

45. The method of claim 38, wherein the formed FSG film has a gap filling ability of from about 0.17 to 0.21μm.

46. The method of claim 38, wherein the formed FSG film includes the following characteristics:

a) THK U% of from about 1.75 to 1.81%;

b) WIW range of from about 250 to 350Å;

c) a D/E of from about 2.65 to 2.71; and

d) a %F%U of from about 2.3 to 2.7%.

47. The method of claim 38, wherein the formed FSG film 16 includes the following characteristics:

a) THK U% of from about 1.78%;

b) WIW range of from about 300Å;

c) a D/E of from about 2.68; and

d) a %F%U of from about 2.5%.

48. The method of claim 38, wherein the formed FSG film does not form appreciable Si-OH bonds within about a week of formation.

49. The method of claim 38, wherein the fluorine within the formed FSG film does not appreciably outgas from the formed FSG film.

50. The method of claim 38, including the step of forming at least two adjacent metal structure upon the structure before the formation of FSG film.

51. The method of claim 38, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film.

52. The method of claim 38, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include

corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film; the metal structure being comprised of copper, aluminum or gold.

53. The method of claim 38, including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film; the metal structure being comprised of copper or aluminum.